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THE trustees of Cooper Union, New York City, have authorized the organization of a four-year day course in industrial chemistry to be started in September of the present year. This course will aim to train men as analysts, research chemists, foremen and superintendents in manufacturing plants, and sales agents. Mr. Maximilian Toch, has been appointed adjunct professor of industrial chemistry.

DR. H. E. ROAF has been appointed to the university chair of physiology tenable at the London Hospital Medical College, and Professor T. Swale Vincent to the university chair of physiology tenable at the Middlesex Hospital Medical School.

DISCUSSION AND CORRESPONDENCE

AN ODD PROBLEM IN MECHANICS

TO THE EDITOR OF SCIENCE: The following statements are intended to throw light on the questions raised by Dr. Hering in his letter entitled "An odd problem in mechanics" in SCIENCE for January 9, 1920.

The statements in the second paragraph of the letter are correct: a body travelling eastward on the ground along the equator will exert less pressure on the ground than one at rest relative to the earth's surface, and still less pressure than a body travelling westward. The correctness of this statement was verified experimentally in connection with observations to determine the intensity of gravity at sea by determinations of the boiling point compared with readings of the mercury barometer. In the spring of 1909 the Russian government placed a war ship at the disposal of Professor Hecker, who was engaged in this work, and tests were made in the Black Sea by comparing the gravity obtained when the ship was running east with gravity at the same point when the ship was running west. The correction in question is of the order of 0.100 dyne for a vessel of fair speed, and the reality of the expected effect and the necessity of applying a correction for it were, of course, verified. It should be mentioned that the rolling, pitching and lifting of the ship, which occur on all courses, were such

that the total effect of the ship's motion did not necessarily reverse in sign when the ship's course was reversed.

In the third paragraph it is assumed that the "gyroscopic tendency (of a rotating horizontal flywheel) to get into the vertical plane has been counteracted and may be neglected." But the forces Dr. Hering has been describing in this paragraph are exactly the gyroscopic forces themselves that tend to make the axis of the flywheel parallel to the earth's axis. At the equator, since the celestial pole is in horizon, the plane of the flywheel would tend to become vertical. If the gyroscopic tendency is counteracted, there is, of course, no shifting of the axis of rotation.

In the cases supposed in the fourth paragraph, there are gyroscopic forces arising from the earth's rotation that Dr. Hering has not considered. When the plane of rotation is north and south, that side of the disk which is descending will tend to move eastward, and the side that is ascending will tend to move westward, thus tending to turn the plane of the disk out of the meridian into the prime vertical, so that its axis shall be parallel to the axis of the earth. The apparatus will therefore not be dynamically balanced as Dr. Hering states. At the equator there is no twisting effect due to the horizontal motion of the particles on the edge of the disk, for this effect varies as the sine of the latitude. At the equator, when the plane of the disk is east and west, its axis is parallel to the earth's axis, and the apparatus is dynamically balanced.

The nature of the general question raised may be stated in a few words as follows. For a body at rest on the earth, it is sufficient to consider only the attraction of the earth and the centrifugal force due to the earth's rotation. For a body in motion relative to the earth, there are additional apparent forces to be considered, the so-called gyroscopic forces, or compound centrifugal forces. These apparent forces arise from the fact that our axes of reference are not fixed in direction in space, but are rotating. These forces are all proportional to the product of the earth's angular velocity of rotation by a component velocity

along one of the moving axes; furthermore, all components of relative velocity, northward, eastward, or upward (and their opposites) give rise to these forces. Dr. Hering's argument from the varying centrifugal force due to the east and west motion of a particle brings to light the gyroscopic forces due to the east-and-west components of velocity, but it does not tell the whole story. Vertical components, and horizontal components in the meridian must also be allowed for.

There is nothing very new in the results stated above. Problems of moving axes and the effect of the earth's rotation are treated in much detail in advanced treatises like Routh's "Rigid Dynamics." The equations of motion for these cases can be conveniently ground out by Lagrange's method, but it is always interesting and instructive to obtain each term in the result directly, and to examine its geometrical and mechanical meaning.

WALTER D. LAMBERT

U. S. COAST AND GEODETIC SURVEY

QUOTATIONS

FEDERATIONS OF BRAIN WORKERS

IN the discussion on the better adjustment of the relations between employers and employed which have occupied so much space in the public press during the last year or so attention has been almost exclusively directed to the relations of industrial employers and manual workers. The interests of other classes of persons whose work is essential to industry have been almost ignored, although the Labor Party has declared its willingness to accept recruits from among brain workers. At the industrial conference summoned by the Prime Minister last April employers' associations and trade unions considered a proposal for a joint industrial council, and the Society of Technical Engineers at this conference moved an instruction to the council, when it should come into existence, to consider the position of unions composed exclusively of members of technical, management, and administrative grades, and to determine how such unions should be represented on

the council. The industrial council has not yet come into existence, but meanwhile the Labor Research Department has been making inquiries into the position of professional classes in relation to the labor movement, and at a meeting in London on February 7, a National Federation of Professional, Technical, Administrative, and Supervisory Workers was formed. The bodies represented at this conference included the Civil Servants Union, the Association of Local Government Board Officers, the National Union of Clerks, the National Federation of Law Clerks, the National Union of Journalists, representatives of scientific, technical, engineering, and chemical workers, together with the Actors' Association and the National Orchestral Association. A representative of the Labor Research Department said that it was not proposed that the Federation should affiliate with the Labor Party or the Trade Union Congress. Among the professions invited to join the new Federation medicine and the law are not included. It appears, however, that for some months past certain technical and scientific professional workers have been taking steps to form themselves into a confederation, and that representatives of these bodies and several others, after full discussion, have prepared a memorandum proposing that the various societies concerned should be formed into an industrial group, a financial group, a group for the public services, and a group for the other professions. Each group would form a federation, and the four would be combined into a confederation for which draft rules are being prepared. The General Secretary of the Society of Technical Engineers last week published a long letter on the subject in *The Times*, in the course of which he observed that the assumption that a salaried official must ally himself either with the employers or with the work-people ought not to be accepted without further investigation. The position of medicine and the law are similar to each other and differ fundamentally from that of the intellectual workers represented by such bodies as the Society of Technical Engineers. The medical profession